

PRESENTATION BEFORE LEGISLATIVE TASK FORCE – SOUTH PLATTE BASIN

June 29, 2007

Greeley, Colorado

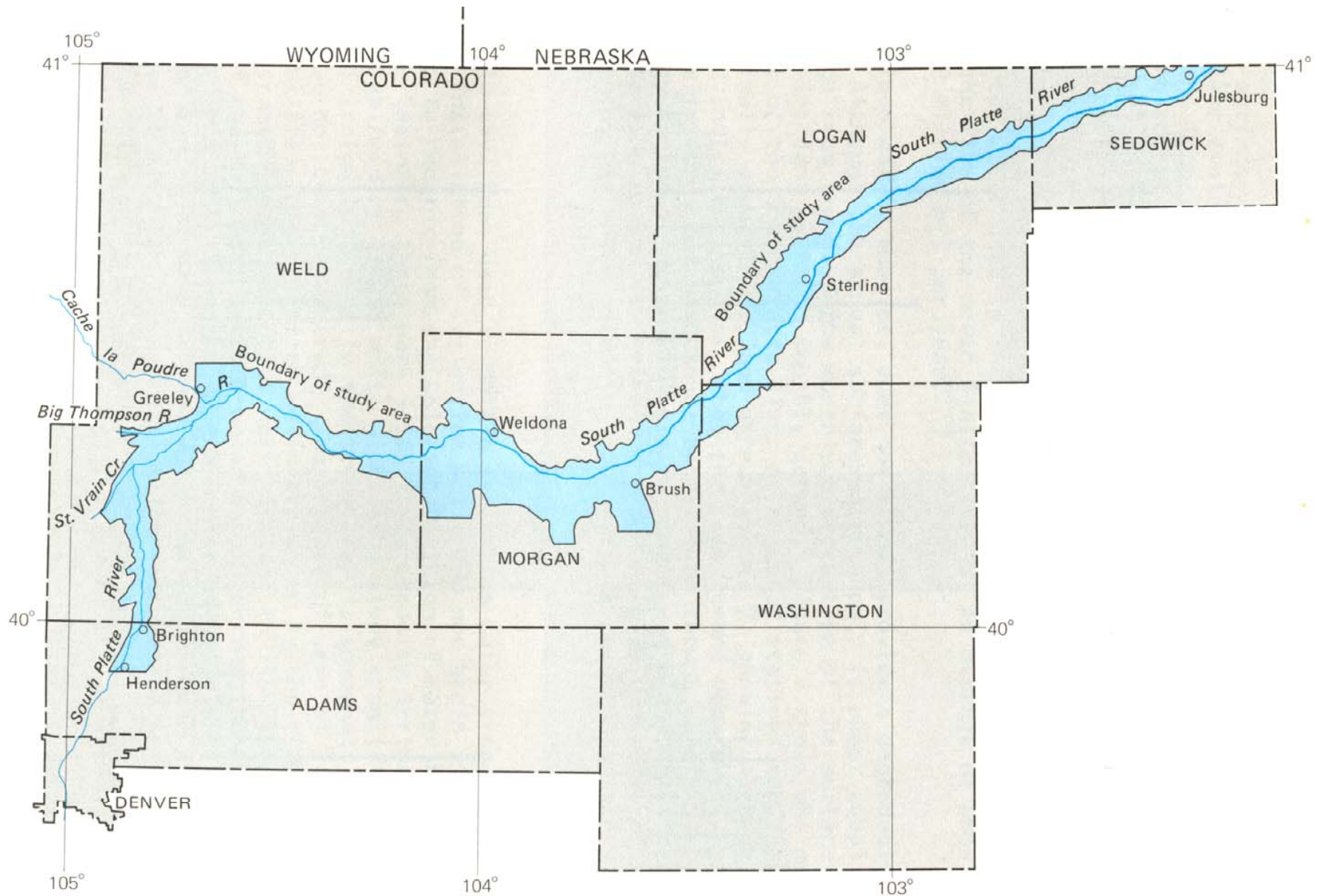
Presented by
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Consultant Water Engineer

Colorado's Alluvial Aquifers Are a Valuable Source of Water

<u>Aquifer</u>	<u>Storage</u> <u>Millions of AC-ft.</u>
• South Platte Alluvium	8.5 - 25
• Arkansas River Alluvium	1.5 - 1.9
• San Luis Valley	2,000

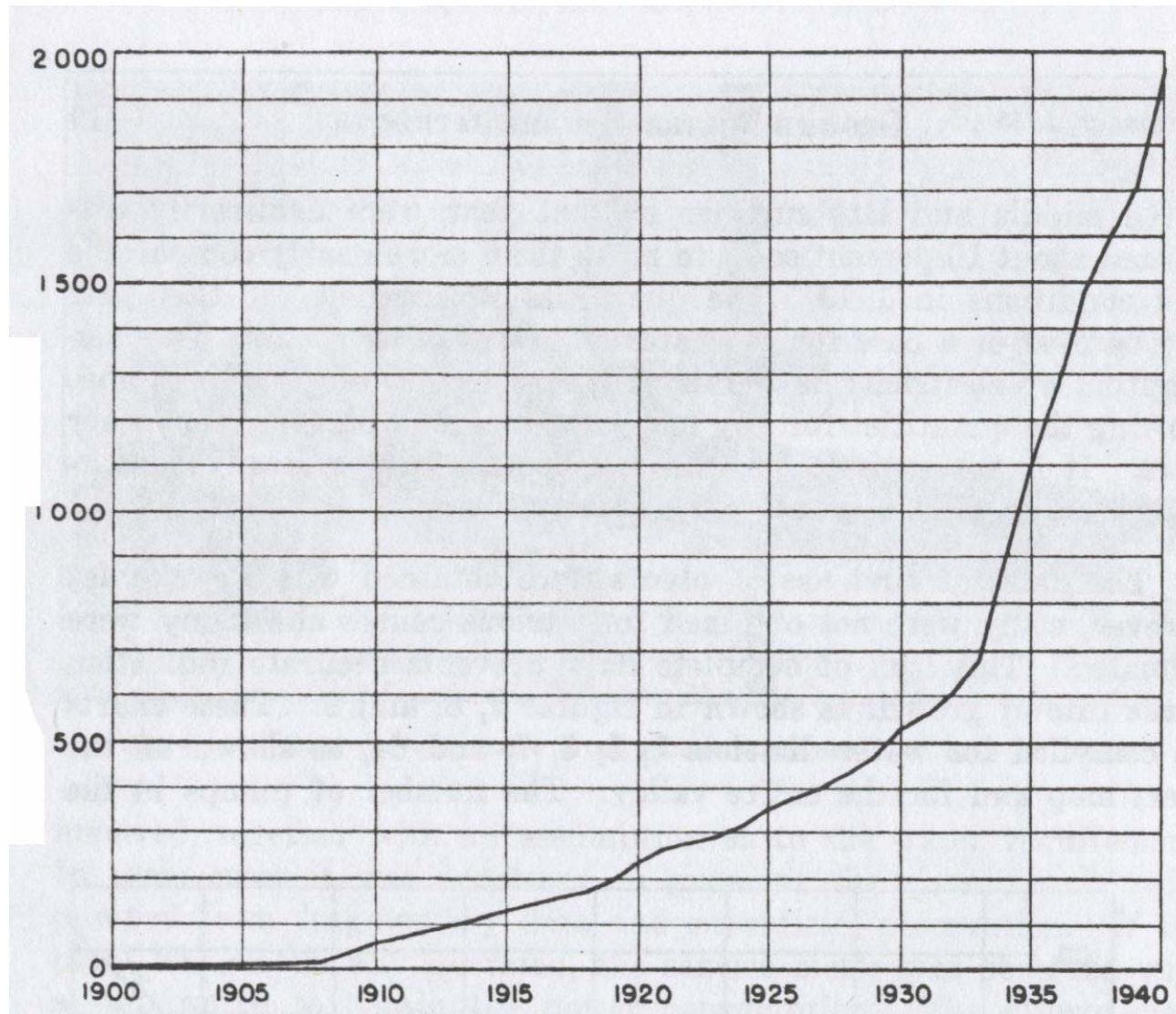
Similarity Of The Three Alluvial Aquifers

- River is hydraulically connected to the underlying aquifer
- Natural recharge occurs from deep percolation of both irrigation water and precipitation
- Wells were constructed to supplement surface flows
- Wells intercept and consume ground water, which would have flowed to the stream
- The river systems are over appropriated
- Each has a river compact with downstream states
- There are transbasin diversions into each system

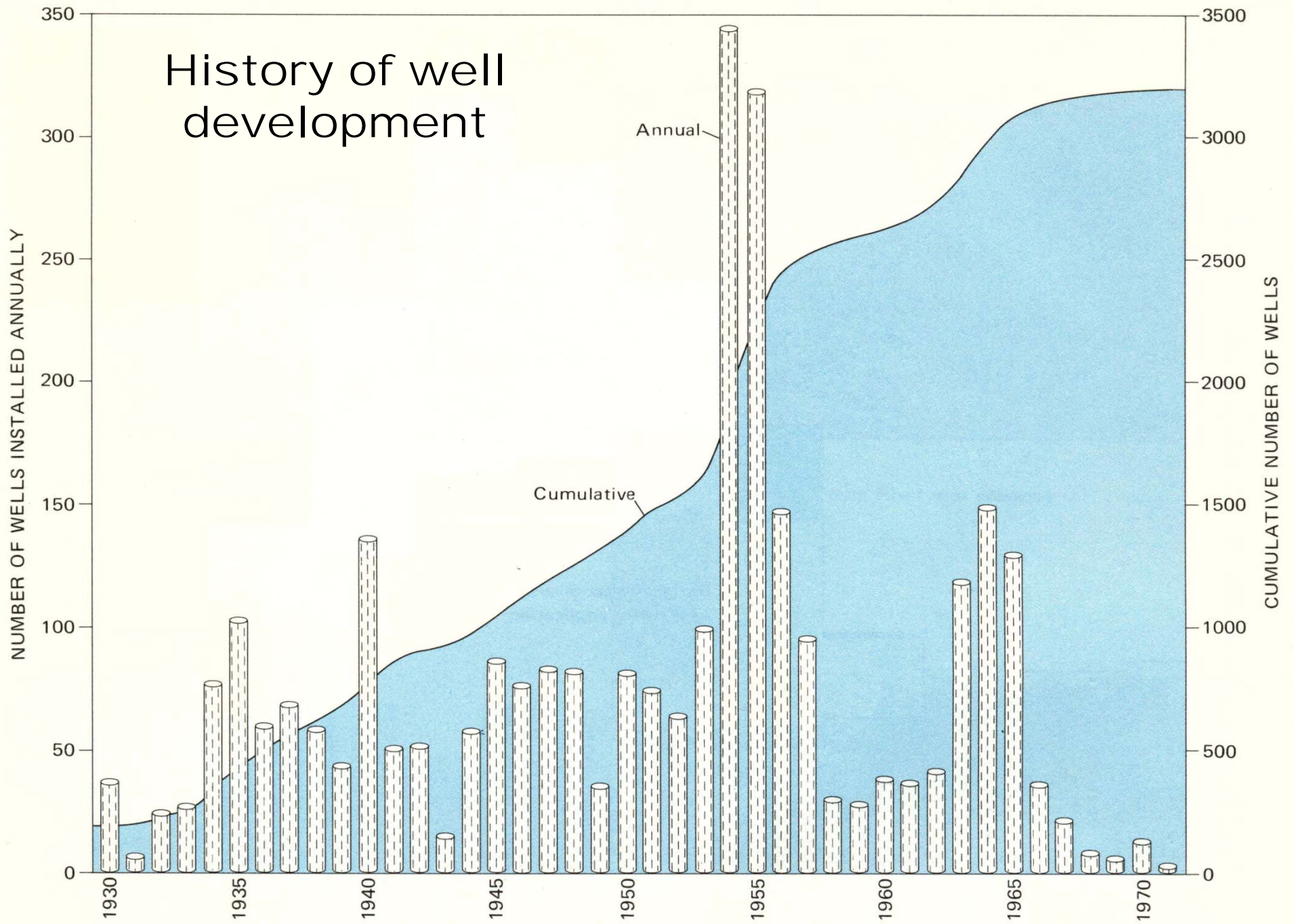


South Platte River Basin Alluvium

Code's History of Well Development



History of well development



HURR, SCHNEIDER, AND MINGES

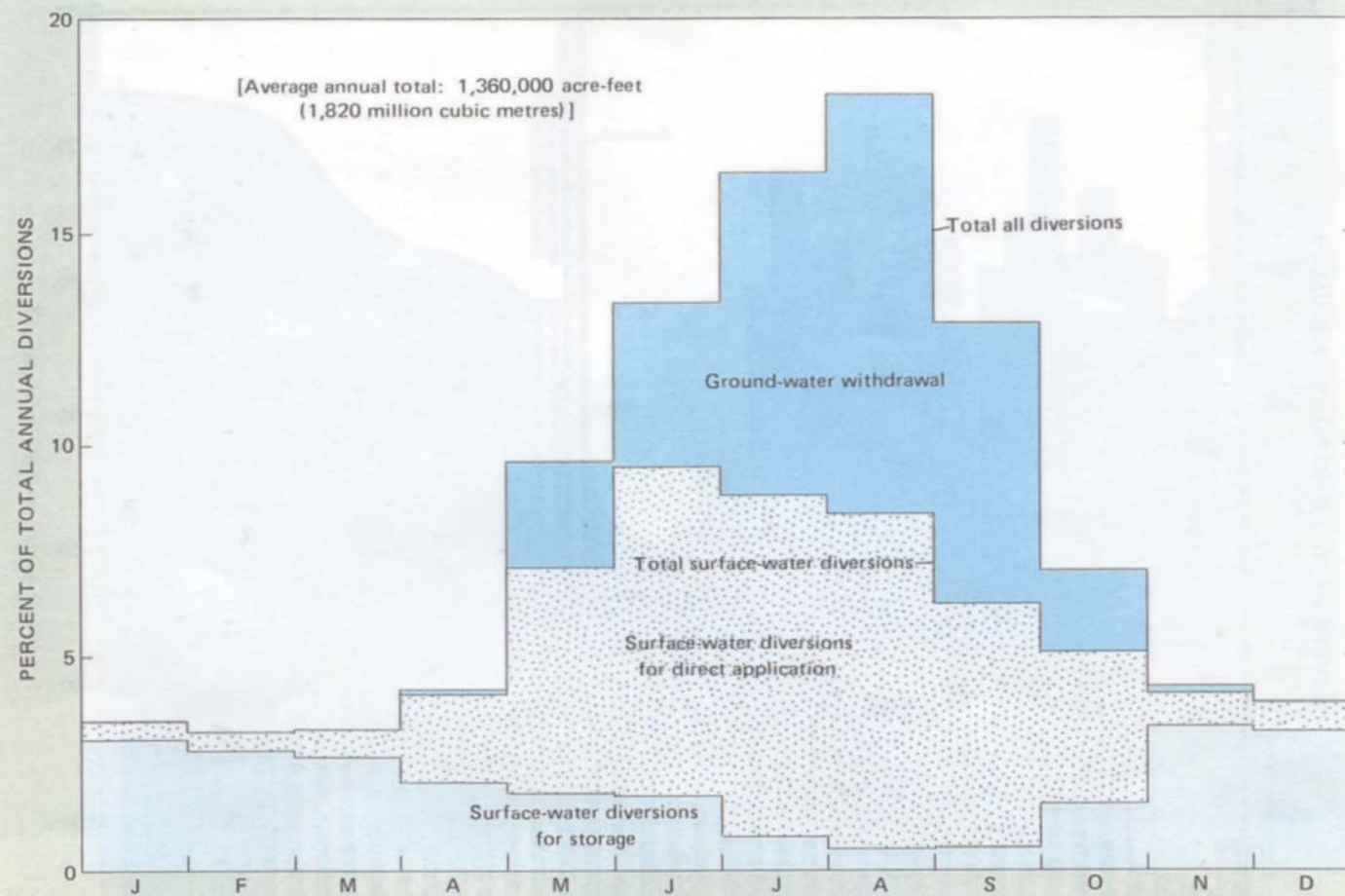


Figure 7. — Average monthly diversions, 1952–65, between Henderson, Colo., and the Colorado-Nebraska State line.

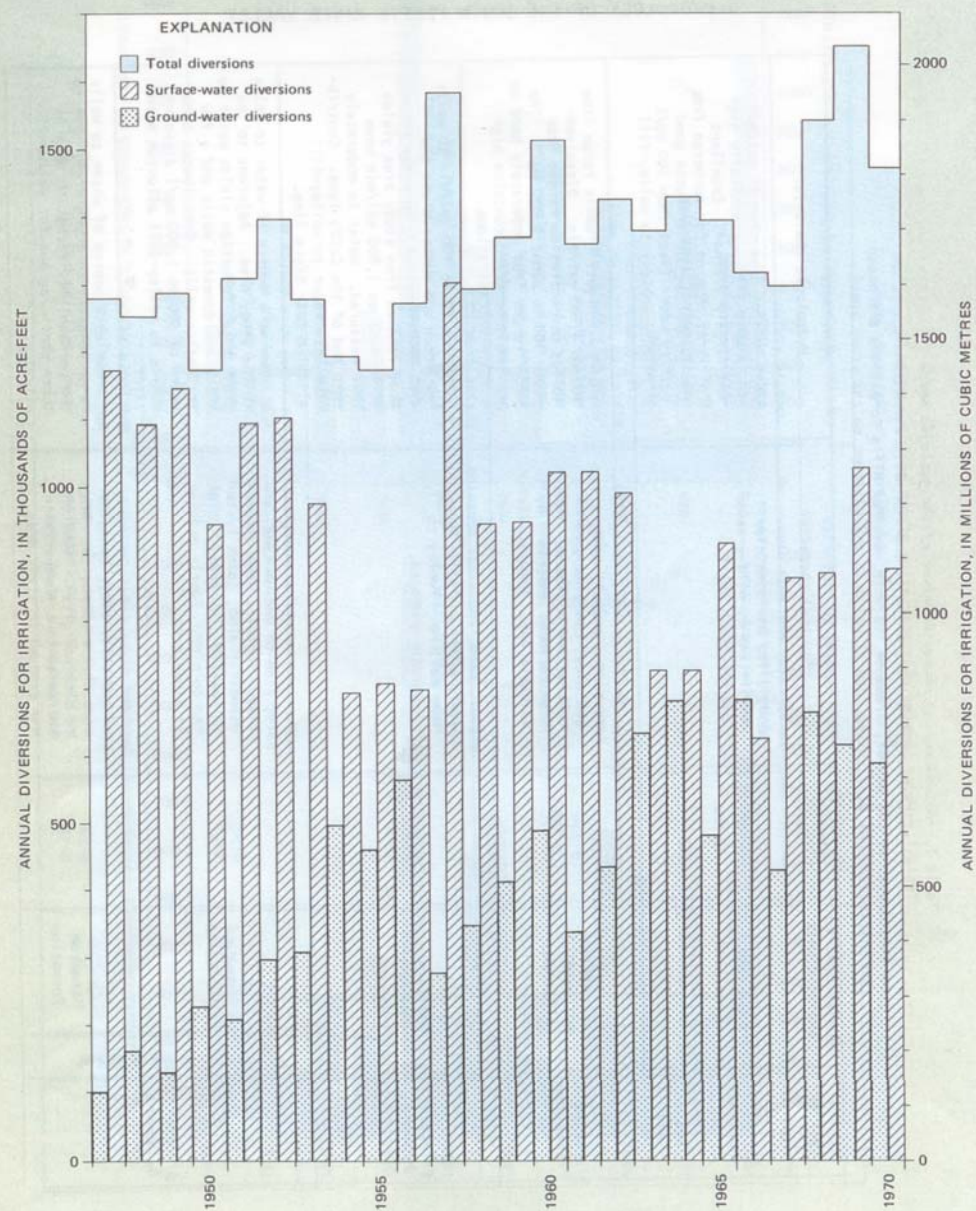


Figure 9. — Estimated annual irrigation diversions, 1947–70.

MONTHLY EVAPOTRANSPIRATION, AS PERCENT OF ANNUAL

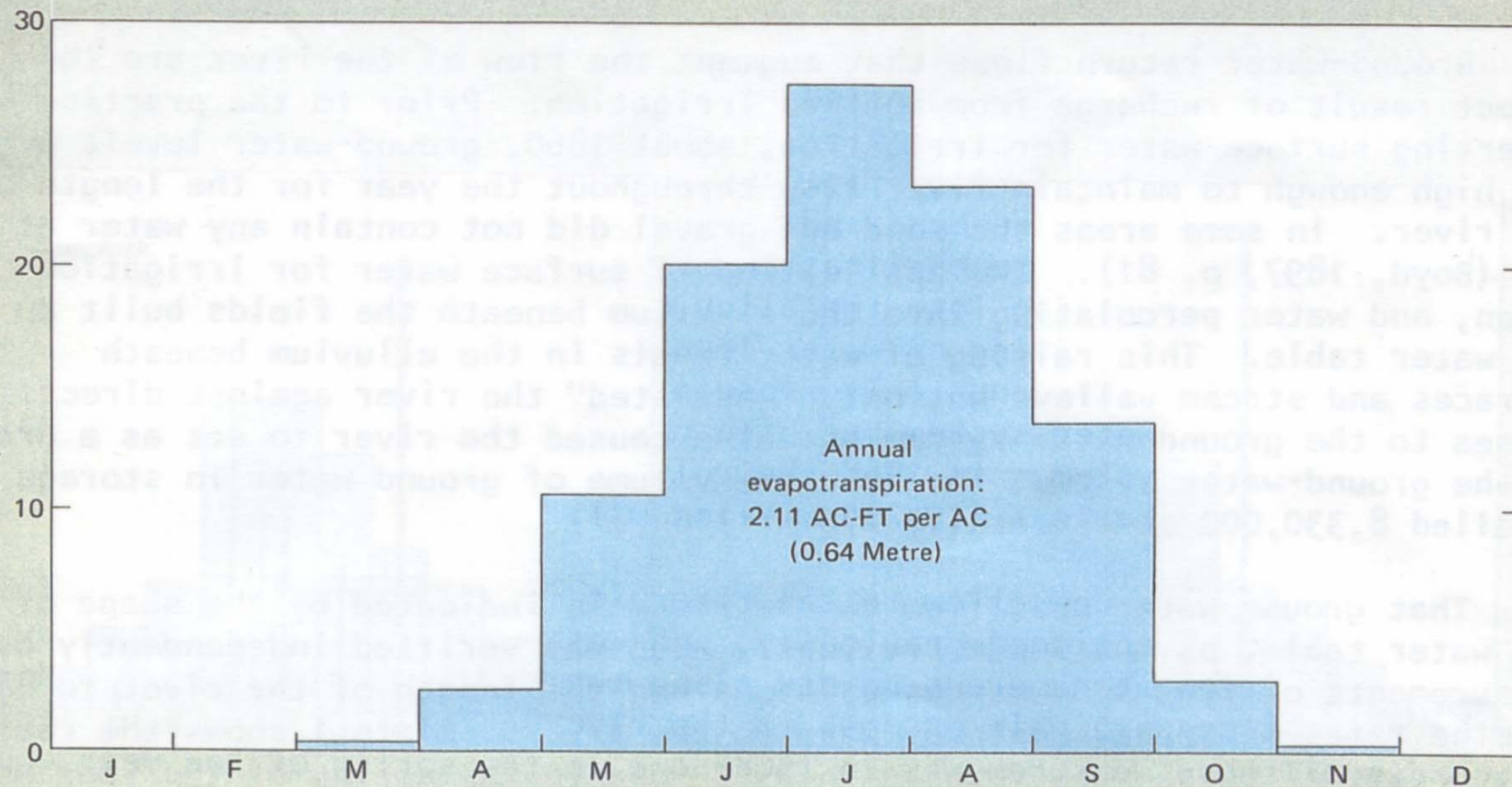
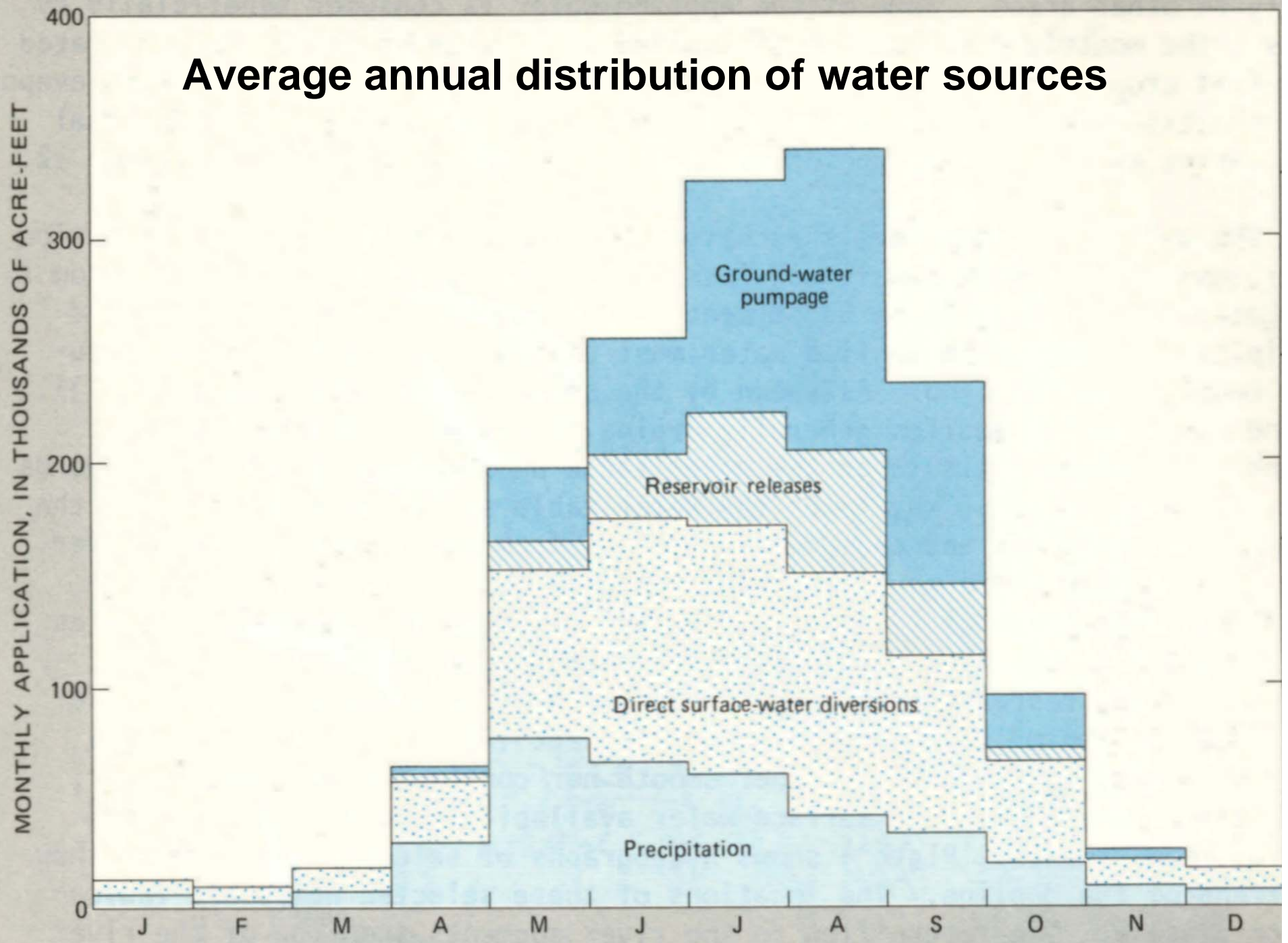
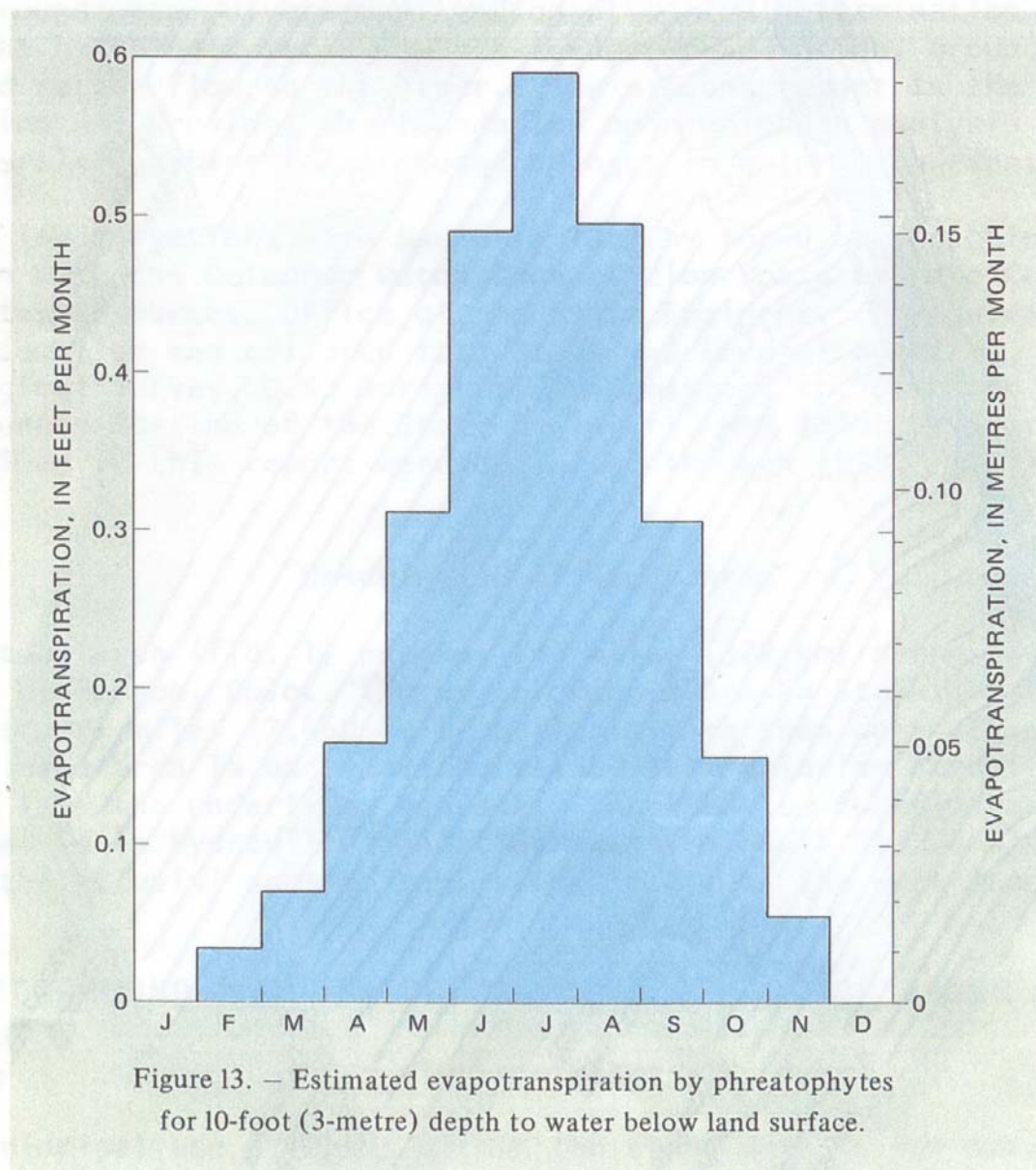


Figure 11. — Monthly application of irrigation water and estimated potential crop evapotranspiration.

Average annual distribution of water sources





Colorado Citizens Have Practiced Conjunctive Use Since The First LARGE Capacity Wells Were Drilled In The Early 1900's

- Deep percolation from irrigation recharged the aquifer
- Streams had perennial flows in 1890's
- Rivers became gaining streams (1890-1910)
- First large capacity wells constructed in early 1900's

Well impact on stream flows

Code's statements - page 9 of 1943 report

1960's issue - senior ditches claimed injury from wells

Water Congress Newsletter history 1962-69

RAL Recollection

Studies funded by Colorado

1962-65 CSU/USGS Ark Valley

1966 Senate Bill 407 - Bittinger, Wheeler

1967 USGS - Circular #28

1967 Water Integration Committee - Vandmoer

1969 Act passed

2000's Same issue but more polarized

Code's Sept. 1943 Report

The tremendous value of water from wells in this Valley is universally admitted even by those whose river rights might possibly be affected. The tendency in late years is to recognize that wells are a source of immediate relief in case of water shortage and that, even if return flow is affected, the injury so engendered is probably of less importance than the total economic benefits derived. The significance of this attitude will be recognized from the fact that 80 percent of the pumping plants are operated in conjunction with surface water rights. It has the effect of diminishing the probability of litigation. Such litigation could have far-reaching results of undesirable character unless it was properly presented in court and was of rather broad scope. No legislation should be attempted which is directed at the control of pumping without having at hand competent state-wide data on the subject. The data gathered in the survey of 1940-41 are but a part of the information required for a full understanding of the problem.

1965 Ground Water Management Act

- State Engineer has to find un-appropriated water is available and no injury to other water rights before issuing a new well permit
- State Engineer is to administer both surface and tributary ground water in accordance with prior appropriation doctrine
- Designated Groundwater and role of Management Districts was clarified

(1967-68) Senate Bill 407 Studies:

- Bittinger (South Platte - Water District #1)
- Wheeler and Associates, Woodard - Clyde and Associates (Arkansas - Pueblo to State Line)

Study objectives:

- Determination of well pumping impact on stream and ditch diversion flows
- Feasibility of conjunctive use to maximize sustainable water supply
- Need for total basin management
- Water quality issues must be considered

Bittering Conclusions From 407 Studies

Groundwater development and use has removed much of the uncertainty of supply for those water users fortunately situated. Subsequent exchanges and leasing of reservoir shares by ditches and individuals changing to greater groundwater use has tended to stabilize supplies even for those who have not been able to develop groundwater supplies.

Bittering Conclusions From 407 Studies

- The large alluvial aquifer underlying most of the irrigated land along the South Platte in Water District 1 can serve as very efficient long-term storage facility with which, assuming economic feasibility, all uncertainties and inequities of supply can be virtually eliminated.
- Full integrated management of groundwater and surface water should be planned for the entire basin, not just the area involved in this study, in order to achieve maximum benefits.

Wheeler Conclusions From 407 Studies

The best utilization of the basin water resources could be accomplished through the integrated or conjunctive use of wells, the storage of winter flows and excessive diversions and the delivery of water in phase with crop requirements.

Any management plan for conjunctive use must be basin-wide to protect vested water rights in accordance with the Appropriation Doctrine. Flexibility and security are two important criteria in any basin management plan.

1969 Water Rights Determination And Administration Act

- Wells were required to obtain a decree to establish a priority date
- Concept of augmentation to allow out of priority diversions was codified
- Augmentation required replacement in time, place, and amount to prevent injury to senior rights
- Required maximizing Colorado's limited water supply for as many uses as possible

Drought 2001-2002

Gauging Station Data - 2001, 2002, 2003, and long term average.

Augmentation water not available

Observation well data - March 2003

Need to pump G.W. during droughts

Cost for augmentation water

Reduced return flows due to lower diversions.

Stream Outflow From Mountain To Plains

Flow Through Gauging Stations - Ac-ft/Water Year

Stream	2001	2002	2003	1975-2002
South Platte River	335,400	289,200	241,900	270,100
Bear Creek	20,680	8,660	33,700	37,880
Clear Creek	125,400	57,110	140,000	138,400
Boulder Creek	36,810	17,550	61,140	53,287
St. Vrain Creek	53,930	24,980	100,300	90,078
Big Thompson River	55,410	38,730	57,290	52,550
Cache La Poudre River	<u>139,100</u>	<u>64,830</u>	<u>217,800</u>	<u>240,263</u>
	766,730	501,060	852,130	882,558
Trans-mountain	<u>544,050</u>	<u>503,438</u>		

Imperative to find a way to pump
GW during droughts - Benefits all
Colorado Citizens - even most
senior water rights

Impacts of Recent Court Cases and Legislation

Restrict the use of the groundwater resources to meet the demands during drought periods

However:

When in a drought we need to pump groundwater

Retrogration to pre 1950 conditions

Lost use of nearly half of wells

Lost flexibility of water administration

Reservoir fill policy

Augment Only to keep from having call.

Cooperation between all water rights owners to maximize available water.

Full augmentation has resulted in change in river regimen - possibly less return flows, well augmentation increased river flows.

Wells should be allowed to
divert in their own priority

Infrastructure changes have reduce return flows:

- Lining of canals and pipelines decreases seepage losses.
- Capture of sewage effluent from trans-mountain diversions.
- Increase in phreatophyte consumptive use.
- Endangered species requires more water to be delivered downstream.
- Improved on farm irrigation efficiencies have reduced deep percolation.

- Municipalities, have increased diversions by increasing their allowed diversions.
- Use of gravel pits
- Greater evaporation from shallow reservoirs
- Loss of flexibility for water administration
- Changes from irrigated agriculture to housing developments.
- Changes in diversion and historic irrigation with free water. Because no longer any place to apply the water.

Need good data and
management tools

Maximum utilization using both ground and surface water should be a statewide objective. G.W. storage is crucial for reducing drought and store excess stream flows. 1969 Act was not passed for So. Platte alone.

Suggestions for considerations

- More wells divert as alternate points.
- Use say 2.5 million ac-ft of G.W. aquifer storage as a managed resource
- Consider Bittinger alternative suggestions
- Need agency to manage to achieve maximum utilization objective
- Need to use ground water reservoir for storage.
- Reduce litigation costs.
- All water right owners to come to negotiating table.
- Need everyone to think “outside the box”.

**Need exists for water users,
administrators, legislators and
concerned citizens to think**

outside the box

**of ways to allow greater use of
our stream/aquifer systems to
maximize the water available to
meet Colorado's needs**

Prediction For The Future

- There will be more and more competition to use all of Colorado's water resources
- The management and administration of those resources will be more complex
- Water quality issues will play a more important part in how we use the water

Task Force Challenges:

- Use what we have learned since 1969 Act passage
- Seek goal of maximum utilization and still protect senior rights.
- Determine specific actions needed to achieve maximum utilization goal.
- Utilize and protect Colorado's valuable Ground Water Resource.

Fulton – concrete lined canal

Gravel pit



Surface storage replaces gravel aquifer



Burlington / O'Brien Canal

Available to divert flood flows

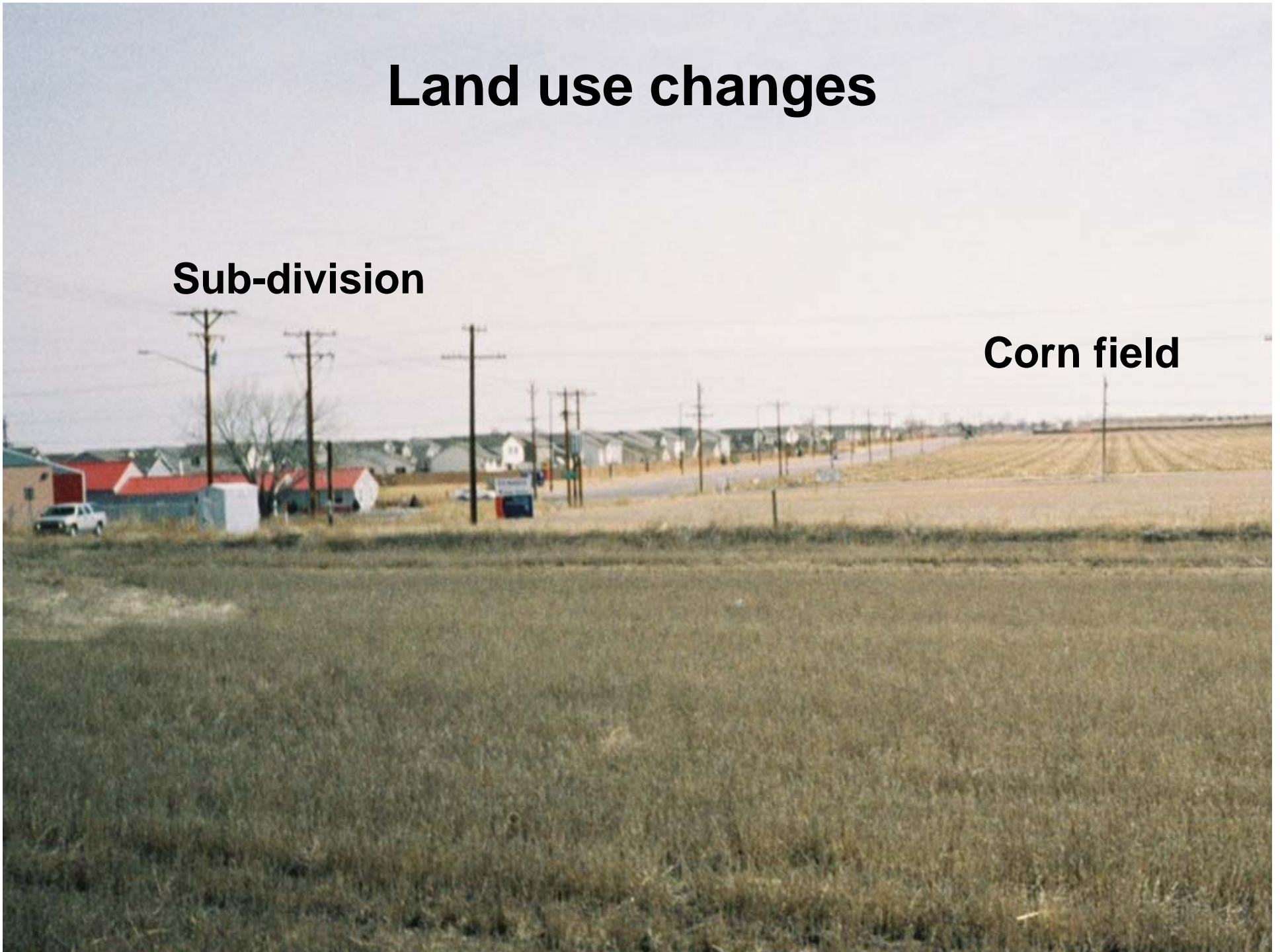
Capacity 2000 cfs



Land use changes

Sub-division

Corn field



Techniques Developed To Quantify Impact of Well Pumping on Stream Flow

- 1941 Thesis, C.V. "The Effect of a Well on the Flow of a Nearby Stream."
- 1954 Glover, RE and GG Balmer "River Depletion Resulting from Pumping a Well Near a River."
- 1955 Hantush, M.S. Discussion of River Depletion Resulting from Pumping a Well Near a River.
- 1967 Bittinger, M.W., H.R. Duke and R. Longenbaugh "Mathematical Simulations for Better Aquifer Management"
- 1968 Jenkins, C.T. "Electric-Analog and Digital – Computer Model Analysis of Stream Depletion by Wells."
- 1968 Glover, RE "The Pumped Well"

1957 Colorado Ground Water Law

- Permit was required to drill a new well
- Required pre 1957 wells to be registered
- Well drillers required to be licensed
- Provided for Designated Ground Water

ACTION BY SENIOR SURFACE RIGHTS

- 1964 Arkansas Valley
- 1964 South Platte River Valley